

9. SISTEMAS DE ECUACIONES LINEALES

1. Sistemas. Es un conjunto de ecuaciones que se refieren al mismo problema.

Ej: Dos números suman 12...

$$x + y = 12$$

y su diferencia es 2.

$$x - y = 2$$

$$\begin{cases} x + y = 12 \\ x - y = 2 \end{cases} \text{ Sistema de dos ecuaciones / con 2 incógnitas}$$

La solución es el valor que cumple todas las ecuaciones.

$$\boxed{x=7} \text{ e } \boxed{y=5}$$

¿Cuál es la solución de...

$$\begin{cases} x + y = 10 \\ x + 2y = 5 \end{cases}$$

La solución del sistema es $\boxed{x=15, y=-5}$

$x + y = 10$	$x + 2y = 5$
$x = 4, y = 6$	$x = 1, y = 2$
$x = -2, y = 12$	$x = 3, y = 1$
$x = 15, y = -5$	$x = 5, y = 0$
	$x = -15, y = -5$

2. Método de sustitución.

Resolver:
$$\begin{cases} x+y=5 \\ 2x-y=7 \end{cases}$$

1º/ Se despeja una incógnita en una ecuación.

$$\boxed{x=5-y}$$

2º/ Se sustituye su valor en la otra ecuación.

$$2 \cdot (5-y) - y = 7$$

3º/ Resolvemos la ecuación:

$$10 - 2y - y = 7$$

$$10 - 7 = 2y + y$$

$$3 = 3y; y = \frac{3}{3} = \boxed{1}$$

4º/ Hallamos la otra incógnita.

$$x = 5 - y = 5 - 1 = \boxed{4}$$

Solución: $\boxed{x=4 \text{ e } y=1}$

5.171 Resuelve:
$$\begin{cases} 2x+y=4 \\ 3x+4y=11 \end{cases}$$

1º/ Despejamos: $\boxed{y=4-2x}$

2º/ Sustitución: $3x + 4 \cdot (4 - 2x)$

3º/ Resolver: $3x + 16 - 8x = 11$

$$3x - 8x = 11 - 16; -5x = -5; \boxed{x = \frac{-5}{-5} = 1}$$

4º/ Hallar $y = 4 - 2x = 4 - 2 \cdot 1 = 4 - 2 = 2$

⑤ Resuelve el siguiente sistema por el método más apropiado:

$$\begin{cases} 2x + y = 4 \\ 3x + 4y = 11 \end{cases}$$

$$\underline{y = 4 - 2x}$$

$$3x + 4 \cdot (4 - 2x) = 11$$

$$3x + 16 - 8x = 11$$

$$-8x + 3x = 11 - 16$$

$$-5x = -5$$

$$\boxed{x = \frac{-5}{-5} = 1}$$

$$\boxed{y = 4 - 2x = 4 - 2 \cdot 1 = 4 - 2 = 2}$$

⑥ Resuelve:

$$\begin{cases} y = 3x \\ 3x + y = 12 \end{cases}$$

$$\underline{y = 3x}$$

$$3 \cdot x + (3x) = 12$$

$$6x = 12$$

$$x = \frac{12}{6}$$

$$\boxed{x = 2}$$

$$y = 3 \cdot 2 = \boxed{6}$$

⑦ Resuelve:

$$\begin{cases} y = 3x + 6 \\ y = 2 - x \end{cases}$$

$$\underline{3x + 6 = 2 - x}$$

$$3x + x = 2 - 6$$

$$4x = -4$$

$$x = \frac{-4}{4} = \boxed{-1}$$

$$y = 2 - x$$

$$y = 2 - (-1)$$

$$y = 2 + 1$$

$$y = \boxed{3}$$

8) Resuelve el siguiente sistema por el método más apropiado.

$$\left. \begin{array}{l} 2x + 3y = -5 \\ x - 2y = 8 \end{array} \right\} \begin{array}{l} x - 2y = 8 \\ \text{1º } x = 8 + 2y \end{array}$$

$$2º \quad 2 \cdot (8 + 2y) + 3y = -5$$

$$3º \quad 16 + 4y + 3y = -5$$

$$4y + 3y = -5 - 16$$

$$7y = -21$$

$$y = \frac{-21}{7} = \boxed{-3}$$

La sol es:

$$\boxed{x = 2 \text{ e } y = -3}$$

$$4º \quad x = 8 + 2 \cdot y, \quad x = 8 + 2(-3);$$

$$x = 8 - 6$$

$$x = \boxed{2}$$

3. Método de igualación.

1º/ Se despeja la misma incógnita en las dos ecuaciones.

2º/ Se igualan.

3º/ Se resuelve la ecuación

4º/ Se halla la otra incógnita.

$$\text{ej: } \begin{cases} 2x + y = 2 \\ -x + y = 1 \end{cases}$$

$$1^\circ / y = 2 - 2x$$

$$y = 1 + x$$

$$2^\circ / \boxed{2 - 2x = 1 + x}$$

$$3^\circ / -2x - x = 1 - 2$$

$$-3x = -1$$

$$x = \frac{-1}{-3} = \boxed{\frac{1}{3}}$$

$$4^\circ / y = 2 - 2 \cdot \frac{1}{3} = 2 - \frac{2}{3} = \frac{6}{3} - \frac{2}{3} = \boxed{\frac{4}{3}}$$

$$\boxed{x = \frac{1}{3}, y = \frac{4}{3}}$$

Resolver:

$$\begin{cases} -2x + y = 2 \\ 3x + y = 12 \end{cases}$$

$$1^\circ / y = 2 + 2x$$

$$y = 12 - 3x$$

$$2^\circ / \boxed{2 + 2x = 12 - 3x}$$

$$3^\circ / 2x + 3x = 12 - 2$$

$$5x = 10$$

$$x = \frac{10}{5} = \boxed{2}$$

Las sol son:

$$\boxed{x = 2; y = 6}$$

$$4^\circ / y = 2 + 2 \cdot (2)$$

$$y = 2 + 4$$

$$y = \boxed{6}$$

⑨ Resolver:

$$\begin{cases} 3x - y = 13 \\ 2x - y = 18 \end{cases}$$

$$1^\circ / y = 3x - 13$$

$$2^\circ \quad 2x - (3x - 13) = 18$$

$$3^\circ \quad 2x - 3x + 13 = 18$$

$$2x - 3x = 18 - 13$$

$$-x = 5$$

$$4^\circ \quad y = 3 \cdot (-5) - 13$$

$$y = -15 - 13$$

$$y = -28$$

Las sol son:

$$y = \boxed{-28} \quad x = \boxed{-5}$$

10) Resuelve:

$$x + y = 1$$

$$3x - y = -9$$

$$y = 1 - x$$

$$y = 9 + 3x$$

Las sol son:

$$\boxed{x = -2} \quad \boxed{y = 3}$$

$$1 - x = 9 + 3x$$

$$y = 1 - (-2)$$

$$-x - 3x = 9 - 1$$

$$y = 1 + 2$$

$$-4x = 8$$

$$y = \boxed{3}$$

$$x = \frac{8}{-4} = \boxed{-2}$$

11) La suma de dos números es 8 y el doble del primero más el triple del segundo es 19. Halla el valor de ambos números.

$$x + y = 8$$

$$2 \cdot x + 3 \cdot y = 19$$

$$x = 8 - y$$

$$2 \cdot (8 - y) + 3 \cdot y = 19$$

$$16 - 2y + 3y = 19$$

$$y = 19 - 16$$

$$\boxed{y = 3}$$

$$x = 8 - 3$$

$$\boxed{x = 5}$$

(12) La suma de dos números es 11, y su diferencia es 3. Halla el valor de ambos números.

$$\left. \begin{array}{l} x+y=11 \\ x-y=3 \end{array} \right\} \begin{array}{l} x=11-y \\ x=3+y \end{array}$$

$$x=3+y$$

$$x=\boxed{7}$$

$$3+y=11-y$$

$$3-11=-y-y$$

$$-8=-2y$$

$$y=\frac{-8}{-2}=\boxed{4}$$

(13) Halla dos números proporcionales a 3 y 5 cuya suma es 16.

$$\frac{x}{3} = \frac{y}{5}$$

$$x+y=16$$

$$y=\frac{5x}{3}$$

$$y=16-x$$

$$y=16-6$$

$$y=\boxed{10}$$

$$\frac{5x}{3} = \frac{48-3x}{3}$$

$$\frac{5x}{3} = 16-x$$

$$5x = 48-3x$$

$$\frac{5x}{3} = \frac{48}{3} - \frac{3x}{3}$$

$$5x+3x=48$$

$$8x=48$$

$$x=\frac{48}{8}=\boxed{6}$$

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4. Método de reducción

1º/ Conseguir dos coeficientes opuestos.

2°/ Sumar una ecuación a otra.

3°/ Resolver ecuación.

4°/ Hallar otra incógnita

14.173 Resuelve:

$$\begin{cases} 1^\circ/ 3x + 2y = 23 \\ 5x - 2y = 17 \end{cases}$$

2°/ $8x = 40$

3°/ $x = \frac{40}{8} = 5$

$3 \cdot 5 + 2 \cdot y = 23$

$2y = 23 - 15; 2y = 8; y = \frac{8}{2} = 4$

15.173 Resuelve:

$$\begin{cases} 5x + 3y = 7 \\ 4x + 3y = 5 \end{cases}$$

$$\begin{cases} 1^\circ/ 5x + 3y = 7 \\ -4x - 3y = -5 \end{cases}$$

2°/ $x = 2$

3°/ $x = 2$

4°/ $5x + 3y = 7$

$5 \cdot 2 + 3y = 7;$

$10 + 3y = 7;$

$3y = 7 - 10 = -3$

$y = \frac{-3}{3} = -1$

$x = 2 \quad y = -1$

17.173 Resuelve:

$$\begin{cases} 2 \cdot (2x + 3y = -4) \\ 5x - 6y = 17 \end{cases}$$

1°/ $4x + 6y = -8$

$5x - 6y = 17$

2°/ $9x = 9$

3°/ $x = \frac{9}{9} = 1$

4°/ $2x + 3y = -4$

$2 \cdot 1 + 3y = -4$

$2 + 3y = -4; 3y = -4 - 2;$

$y = \frac{-6}{3} = -2$

(18) Resuelve el siguiente sistema por el método más apropiado:

$$\left. \begin{array}{l} 3 \cdot (4x + 3y = 1) \\ 2 \cdot (-6x + 5y = 27) \end{array} \right\}$$

$$12x + 9y = 3$$

$$-12x + 10y = 54$$

$$12x + 9y = 3$$

$$12x + 27 = 3$$

$$27 - 3 = 12x$$

$$24 = 12x$$

$$x = \frac{24}{12} = 2$$

$$19y = 54$$

$$y = \frac{54}{19}$$

$$y = 3$$

(19) Resuelve el siguiente sistema:

$$\left. \begin{array}{l} 4 \cdot (3x + 5y = -12) \\ 3 \cdot (4x - 7y = 25) \end{array} \right\}$$

$$12x + 20y = -48$$

$$12x - 21y = 75$$

$$12x + 20(-3) = -48 \quad 12x + 20y = -48$$

$$12x - 60 = -48 \quad -12x + 21y = -75$$

$$-60 + 48 = -12x$$

$$-12 = -12x$$

$$x = \frac{-12}{-12}$$

$$x = 1$$

$$+41y = -123$$

$$y = \frac{-123}{41}$$

$$y = 3$$

(44) Resuelve:

$$\left. \begin{array}{l} x + 2y = 4 \\ x = 3y - 11 \end{array} \right\}$$

$$x = 4 - 2y$$

$$x = 3y - 11$$

$$3y - 11 = 4 - 2y$$

$$3y + 2y = 4 + 11$$

$$5y = 15$$

$$y = \frac{15}{5} = \boxed{3}$$

$$y = 3.3 \text{ 12}$$

$$x = 0 - 11$$

$$x = \boxed{-2}$$

45) Resolve:

$$\begin{cases} 2(5x + 3y = 12) \\ 7x - 6y = 27 \end{cases}$$

$$10x + 6y = 24$$

$$20 - 24 = -6y$$

$$6 = -6y$$

$$y = \frac{6}{-6} = \boxed{-1}$$

$$10x + 6y = 24$$

$$7x - 6y = 27$$

$$17x = 51$$

$$x = \frac{51}{17} = \boxed{3}$$

46) Resolve:

$$\begin{cases} 4(-2x - 3y = 11) \\ 3(5x - 4y = 30) \end{cases}$$

$$-8x - 12y = 44$$

$$15x - 12y = 90$$

$$15 \cdot 2 - 12y = 90$$

$$20 - 90 = 12y$$

$$-60 = 12y$$

$$y = \frac{-60}{12} = \boxed{-5}$$

$$-8x - 12y = 44$$

$$-15x + 12y = -90$$

$$-23x = -46$$

$$x = \frac{-46}{-23} = \boxed{2}$$

47) Resolve:

$$\begin{cases} 3(5x + 4y = 7) \\ 2(7x - 6y = 33) \end{cases}$$

$$15x + 12y = 21$$

$$14x - 12y = 66$$

$$15 \cdot 3 + 12y = 21$$

$$29x = 87$$

$$45 - 21 = -12y$$

$$x = \frac{87}{29} = \boxed{3}$$

$$24 = -12y$$

$$y = \frac{24}{-12} = \boxed{-2}$$

Resolver por los 3 métodos:

$$3x + 5y = 11$$

$$6x + 7y = 5$$

Sustitución

$$3x = 11 - 5y$$

$$x = \frac{11 - 5y}{3}$$

$$6 \cdot \left(\frac{11 - 5y}{3} \right) - 7y = 5$$

$$\frac{66 - 30y}{3} - 7y = 5$$

$$\frac{66 - 30y}{3} - \frac{21y}{3} = \frac{15}{3}$$

$$\frac{66 - 30y - 21y}{3} = \frac{15}{3}$$

$$66 - 30y - 21y = 15$$

$$-51y = 15 - 66$$

$$-51y = -51$$

$$y = \frac{-51}{-51} = 1$$

$$x = \frac{11 - 5 \cdot 1}{3}$$

$$x = \frac{11 - 5}{3} = \frac{6}{3} = 2$$

Igualación

$$x = \frac{11 - 5y}{3}$$

$$x = \frac{5 + 7y}{6}$$

$$\frac{11 - 5y}{3} = \frac{5 + 7y}{6}$$

$$\frac{22 - 10y}{6} = \frac{5 + 7y}{6}$$

$$22 - 10y = 5 + 7y$$

$$-10y - 7y = 5 - 22$$

$$-17y = -17$$

$$y = \frac{-17}{-17}$$

$$y = 1$$

$$6x = 5 + 7y$$

$$x = \frac{5 + 7y}{6}$$

$$x = \frac{5 + 7 \cdot 1}{6}$$

$$x = \frac{5 + 7}{6}$$

$$x = \frac{12}{6}$$

$$x = 2$$

-Reducción

$$\begin{cases} (-2) \cdot \begin{cases} 3x + 5y = 11 \\ 6x - 7y = 5 \end{cases} \end{cases}$$

$$\begin{aligned} -6x - 10y &= -22 \\ 6x - 7y &= 5 \end{aligned}$$

$$3x + 5 \cdot 1 = 11$$

$$-17y = -17$$

$$3x + 5 = 11$$

$$y = \frac{-17}{-17} = 1$$

$$3x = 11 - 5$$

$$3x = 6$$

$$x = \frac{6}{3} = 2$$

22.176 La suma de 2 números es 20 y el doble ^{del primero} más el triple del segundo es 45. Halla el valor de ambos números.

x: un n°

y: otro n°

$$\begin{cases} (-2) \cdot \begin{cases} x + y = 20 \\ 2x + 3y = 45 \end{cases} \end{cases} \quad \begin{aligned} -2x - 2y &= -40 \\ 2x + 3y &= 45 \end{aligned}$$

$$x + 5 = 20$$

$$y = 5$$

$$x = 20 - 5$$

$$x = 15$$

23.175 Hay 25 vehículos. Hay 80 ruedas. ¿N° de coches y de motos?

x : n° coches

y : n° motos

$$\left. \begin{array}{l} x + y = 25 \\ 4x + 2y = 80 \end{array} \right\}$$

$$15 + y = 25$$

$$15 - 25 = y$$

$$\boxed{-10 = y}$$

$$y = \boxed{25 - x}$$

$$2y = 80 - 4x$$

$$y = \frac{80 - 4x}{2} = \boxed{40 - 2x}$$

$$40 - 2x = 25 - x$$

$$-2x + x = 40 - 25$$

$$-x = +15$$

$$x = \boxed{-15}$$

24. 175 El aceite de oliva cuesta 3€/l.

Aceite de girasol 2€/l. Tenemos 20 l. de mezcla a un precio de 25€ el litro. ¿Litros de cada clase has mezclado?

x : litros oliva

y : litros girasol

$$\left. \begin{array}{l} x + y = 20 \\ 3x + y = 50 \end{array} \right\}$$

$$y = 20 - x$$

$$y = 50 - 3x$$

$$15 + y = 20$$

$$20 - x = 50 - 3x$$

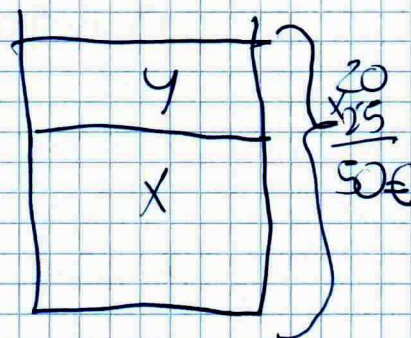
$$y = 20 - 15$$

$$-x + 3x = 50 - 20$$

$$y = \boxed{5}$$

$$2x = 30$$

$$x = \frac{30}{2} = 15$$



(25) Hoy la edad de Miguel es el doble de la edad de María. Dentro de 10 años la suma de sus edades será 65. ¿Cuántos años tiene actualmente cada uno?

	Hoy	Dentro de 10 años
María	x	$x+10$
Miguel	$2x$	$2x+10$

$$2x+10 + x+10 = 65$$

María: 15

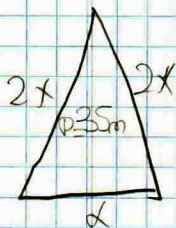
Miguel: 30

$$3x = 65 - 20$$

$$3x = 45$$

$$x = \frac{45}{3} = 15$$

(26) En un triángulo isósceles cada uno de los lados iguales mide el doble del lado desigual y su perímetro mide 35m. ¿Cuánto mide cada lado?



$$2x + 2x + x = 35$$

$$5x = 35$$

$$x = \frac{35}{5} = 7m$$

Desigual: 7m

Iguales: 14m

27) 5 bocadillos de jamón y dos refrescos de cola cuestan 17€ y 3 bocadillos de jamón y 7 refrescos de cola, 16€. ¿Cuánto cuesta cada bocadillo y cada refresco?

$$\begin{cases} 3 \cdot (5x + 2y = 17) \\ 15x + 7y = 16 \end{cases}$$

$$15x + 6y = 51$$

$$-15x - 35y = -80$$

$$-29y = -29; \quad y = 1$$

$$5x + 2 \cdot 1 = 17; \quad 5x = 17 - 2; \quad 5x = 15$$

$$x = \frac{15}{5} = 3; \quad \begin{array}{l} \text{Bocadillo } 3\text{€} \\ \text{Refresco } 1\text{€} \end{array}$$

② Escribe en algebraico las siguientes expresiones:

A) El triple de un número disminuido en 7 unidades.

$$3 \cdot x - 7$$

* B) Dos números impares consecutivos

$$2x+1, 2x+3$$

* ③ Realiza las siguientes operaciones de monomios:

$$a) 4x^5 \cdot (-8x^2) = -32x^7; \quad b) (-5x^2)^3 = -125x^6$$

$$c) x^2 - 7x^2 + 5x^2 - 3x^2 = -10x^2 + 6x^2 = -4x^2$$

$$d) 12x^5 : 18x^3 = \frac{12x^5}{18x^3} = \frac{2x^2 \cdot 3}{3} = \frac{2}{3} \cdot x^2$$

④ Dados los polinomios: $P(x) = 2x^5 - 8x^4 + 7x^2 - 3$;

$Q(x) = 6x^4 - 5x^2 + 9x - 4$. Calcula a) $P(x) + Q(x)$; b) $P(x) - Q(x)$.

$$\begin{array}{r} \text{A)} \quad \begin{array}{r} 2x^5 - 8x^4 \qquad + 7x^2 \qquad - 3 \\ \quad \quad \quad 6x^4 \qquad - 5x^2 + 9x - 4 \\ \hline 2x^5 - 2x^4 \qquad + 2x^2 + 9x - 7 \end{array} \end{array}$$

$$\begin{array}{r} \text{B)} \quad \begin{array}{r} 2x^5 - 8x^4 \qquad + 7x^2 \qquad - 3 \\ \quad \quad \quad - 6x^4 \qquad + 5x^2 - 9x + 4 \\ \hline 2x^5 - 14x^4 \qquad + 12x^2 - 9x + 1 \end{array} \end{array}$$

* ⑥ Calcula:

$$a) (2x + 1/2)^2 = 2x^2 + 2 \cdot 2x \cdot \frac{1}{2} + \left(\frac{1}{2}\right)^2 = 4x^2 + 2x + \frac{1}{4}$$

$$* b) (2x+3) \cdot (2x-3) = 2x^2 - 3^2 = 4x^2 - 9$$

$$c) (x-5)^2 = x^2 - 2 \cdot x \cdot 5 + 5^2 = x^2 - 10x + 25$$

*5) Multiplica los polinomios:

$$p(x) = 3x^3 - 7x - 6; Q(x) = 5x^2 - 9x + 1.$$

Halla el grado del producto.

$$\begin{array}{r} 3x^3 \quad -7x - 6 \\ \times \quad 5x^2 - 9x + 1 \\ \hline 3x^3 \quad -7x - 6 \\ -27x^4 \quad +63x^2 + 54x \\ \hline \end{array}$$

El grado del producto es 5

$$\begin{array}{r} 15x^5: \quad -25x^3 - 30x^2 \\ \hline 15x^5 - 27x^4 - 32x^3 + 33x^2 + 47x - 6 \\ \hline \end{array}$$

② Resuelve:

a) $2 \cdot (3x - 5) - 4 \cdot (x - 2) = 13 - x$

$$6x - 10 - 4x + 8 = 13 - x$$

$$6x - 4x + x = 13 - 8 + 10$$

$$3x = 23 - 8$$

$$3x = 15; x = \frac{15}{3} = \boxed{5}$$

b) $\frac{x-1}{2} - \frac{x+1}{3} = x - \frac{5}{2}$

$$\frac{3x-3}{6} - \frac{2x+2}{6} = \frac{6x}{6} - \frac{15}{6}$$

$$\frac{3x-3-2x-2}{6} = \frac{6x-15}{6}$$

$$3x - 3 - 2x - 2 = 6x - 15$$

$$3x - 2x - 6x = -15 + 2 + 3$$

$$-8x + 3x = 5 - 15$$

$$5x = 10; x = \frac{10}{5} = \boxed{2}$$

③ Resolve:

a) $x^2 - 4x = 0$

$$x \cdot (x - 4) = 0$$

$$x = 0$$

$$x - 4 = 0, x = 4$$

b) $x^2 - 81 = 0$

$$x^2 = 81$$

$$x = \pm\sqrt{81} = 9 \vee -9$$

c) $x^2 + 2x - 15 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4 \cdot a \cdot c}}{2 \cdot a} = \frac{-2 \pm \sqrt{2^2 - 4 \cdot 1 \cdot (-15)}}{2 \cdot 1}$$

$$\frac{-2 \pm \sqrt{4 + 60}}{2} = \frac{-2 \pm \sqrt{64}}{2} = \frac{-2 \pm 8}{2} = \begin{cases} \frac{-2+8}{2} = \frac{6}{2} = 3 \\ \frac{-2-8}{2} = \frac{-10}{2} = -5 \end{cases}$$

d) $3x^2 - \frac{3x}{4} - \frac{9}{8} = 0$

$$\frac{24x^2}{8} - \frac{6x}{8} - \frac{9}{8} = 0$$

$$\frac{24x^2 - 6x - 9}{8} = 0$$

$$24x^2 - 6x - 9 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4 \cdot a \cdot c}}{2 \cdot a} = \frac{-6 \pm \sqrt{(-6)^2 - 4 \cdot 24 \cdot (-9)}}{2 \cdot 24}$$

$$\frac{6 \pm \sqrt{36 - 96 \cdot (-9)}}{48} = \frac{6 \pm \sqrt{36 + 864}}{48} = \frac{6 \pm \sqrt{900}}{48}$$

$$\frac{6 - 30}{48} = \frac{-24}{48} = -\frac{1}{2} \quad \frac{6 + 30}{48} = \frac{36}{48} = \frac{3}{4}$$

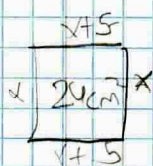
7) Las edades de una madre y un hijo suman 40 años, y dentro de 14 años la edad de la madre será el triple de la del hijo. Calcula la edad actual de cada uno.

	Ahora	Dentro de 14 años
Hijo(x)	x	x+14
madre(y)	40-x	40-x+14

$$\begin{aligned} 54-x &= 3(x+14) \\ 54-x &= 3x+42 \\ 54-42 &= 3x-x \\ 12 &= 2x \\ x &= \frac{12}{2} = 6 \end{aligned}$$

3 Hijo
57 madre

8) Halla el lado de un cuadrado sabiendo que si se aumenta en 5 cm dos de sus lados paralelos, se obtiene un rectángulo de 24 cm².



$$(x+5) \cdot x = 24$$

$$x^2 + 5x = 24$$

$$x^2 + 5x - 24 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4 \cdot a \cdot c}}{2 \cdot a} = \frac{-5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot (-24)}}{2 \cdot 1} =$$

$$\frac{-5 \pm \sqrt{25 + 96}}{2} = \frac{-5 \pm \sqrt{121}}{2} = \frac{-5 \pm 11}{2} =$$

$$\frac{-5 + 11}{2} = \frac{6}{2} = 3$$

$$\frac{-5 - 11}{2} = \frac{-16}{2} = -8$$

La solución negativa
no tiene sentido

④ Resuelve el siguiente sistema:

$$\begin{cases} x - y = 1 \\ y = 2x - 4 \end{cases}$$

$$y = 1 + x$$

$$y = 2x - 4$$

$$y = 1 + 5$$

$$y = \boxed{6}$$

$$2x - 4 = 1 + x$$

$$2x - x = 1 + 4$$

$$x = \boxed{5}$$

⑤ Resuelve:

$$\begin{cases} 2x + y = 0 \\ 3x + 4y = -5 \end{cases}$$

$$y = -2x$$

$$3x + 4 \cdot (-2x) = -5$$

$$3x - 8x = -5$$

$$-5x = -5; x = 1$$

$$y = -2 \cdot 1$$

$$y = \boxed{-2}$$

⑥ Resuelve:

$$\begin{cases} 1-3(2x + 3y = 12) \\ 2(5x - 7y = 2) \end{cases}$$

$$-10x - 15y = -60$$

$$10x - 14y = 2$$

$$2x + 3 \cdot 2 = 12$$

$$-29y = -58$$

$$2x + 6 = 12$$

$$y = \frac{-58}{-29} = \boxed{2}$$

$$2x = 12 - 6$$

$$2x = 6; x = \frac{6}{2} = \boxed{3}$$

⑦ Halla dos números sabiendo que uno es el triple del otro y que el doble del primero más cinco veces el segundo es 85.

$3x$: Un número
 y : Otro número

$$\left. \begin{array}{l} 2x + 5y = 85 \\ + 3x = y \end{array} \right\}$$

$$2x + 5y = 85$$

$$5(3x - y) = 0$$

$$2x + 5y = 85$$

$$15x - 5y = 0$$

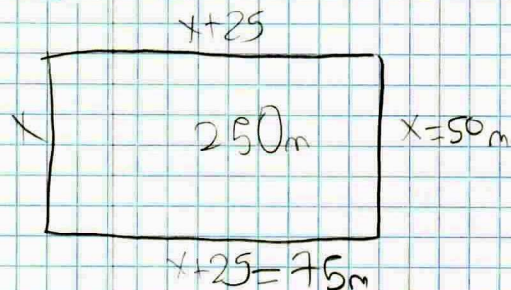
$$17x = 85$$

$$x = \frac{85}{17} = 5$$

$$3 \cdot 5 = y$$

$$y = 15$$

⑧ Una finca rectangular mide 25m más de largo que de ancho. Si el perímetro mide 250m, ¿cuánto mide su área?



$$x + x + x + 25 + x + 25 = 250$$

$$4x + 50 = 250$$

$$4x = 250 - 50$$

$$4x = 200$$

$$x = \frac{200}{4} = 50$$

$$x^2 = 50 + 25 \cdot 50$$

$$x^2 = 75 \cdot 50$$

$$x^2 = 3750 m^2$$

137) Write four solutions for the next equation:

$$x + 2y = 5;$$

$$1. x=1; y=2;$$

$$2. x=5; y=0$$

$$3. x=3; y=1;$$

$$4. x=-1; y=3;$$

138) Check that $x=2; y=4$ is a solution for:

$$\begin{cases} 2x+y=8 \\ x-y=1 \end{cases}$$

$$2 \cdot 2 + 4 = 8 \quad \checkmark$$

$$2 - 4 = 1 \quad \times$$

$x=2$ and $y=4$
aren't solutions.

139) Invent a system of equations with solutions
is $x=4$ and $y=3$.

$$\begin{cases} x+y=7 \\ x-y=1 \end{cases}$$

140) Solve the system by substitution method.

$$\begin{cases} x=2y+5 \\ x-2y=19 \end{cases}$$

$$x=2y+5$$

$$3 \cdot (2y+5) - 2y = 19$$

$$x=2 \cdot 1 + 5$$

$$6y + 15 - 2y = 19$$

$$x = \boxed{7}$$

$$4y = 19 - 15$$

$$4y = 4; y = \frac{4}{4} = \boxed{1}$$

has solution:
 $x=7; y=1$

142) Solve the system by a suitable method.

$$\begin{cases} \frac{x}{3} + \frac{y}{2} = \frac{1}{2} \\ x-2y=2 \end{cases} \quad \text{(First remove the denominators)}$$

$$\frac{2x}{6} + \frac{3y}{6} = \frac{3}{6}$$

$$2x + 3y = 3$$

$$2x + 3y = 3$$

$$2x - 2y = 2$$

$$x = \frac{2y+2}{2}$$

$$2 \cdot \frac{2y+2}{2} - 2y = 2$$

$$-y = 7$$

$$y = \boxed{-7}$$

$$2x + 3y = 3$$

$$-2x - 4y = 4$$

has solution: $x=12, y=-7$

(145) solve by the reduction method:

$$\left. \begin{aligned} \frac{2}{5}x - y + 3 &= 0 \\ -x + 2y - 5 &= 0 \end{aligned} \right\}$$

First take away the denominators

$$\frac{2x}{5} - \frac{5y}{5} + \frac{15}{5} = \frac{0}{5}$$

$$\frac{2x - 5y + 15}{5} = \frac{0}{5}$$

$$x = \frac{5y - 15}{2}$$

$$x = -5 + 2y$$

$$\left. \begin{aligned} 2x - 5y + 15 &= 0 \\ -x + 2y - 5 &= 0 \end{aligned} \right\}$$

$$-5 + 2y = \frac{5y - 15}{2}$$

$$\frac{-10 + 4y}{2} = \frac{5y - 15}{2}$$

$$-10 + 4y = 5y - 15$$

$$+4y - 5y = -15 + 10$$

$$-y = -5$$

$$y = 5$$

$$2x - 5 \cdot 5 + 15 = 0$$

$$2x - 25 = -15$$

$$2x = -15 + 25$$

$$2x = 10$$

$$x = \frac{10}{2} = 5$$

(147) solve the following system by the equalization method:

$$\left. \begin{aligned} 2x + 3y &= 12 \\ 5x - 7y &= 2 \end{aligned} \right\}$$

$$x = \frac{12 - 3y}{2}$$

$$x = \frac{7y + 2}{5}$$

$$\frac{12 - 3y}{2} = \frac{7y + 2}{5}$$

$$\frac{60 - 15y}{10} = \frac{14y + 2}{10}$$

$$60 - 15y = 14y + 2$$

$$-15y - 14y = 2 - 60$$

$$-29y = -58$$

$$y = \frac{-58}{-29} = 2$$

$$2x + 3 \cdot 2 = 12$$

$$2x = 12 - 6$$

$$2x = 6$$

$$x = \frac{6}{2} = 3$$

Las sol son:
 $x = 3; y = 2$

(148) solve the system by reduction method:

$$\left. \begin{aligned} 4x + y &= 5 \\ 3x + 4y &= -6 \end{aligned} \right\}$$

$$16x - 4y = -20$$

$$3x + 4y = -6$$

$$13x = -26; x = \frac{-26}{13} = -2$$

$$4 \cdot 2 + y = 5$$

$$y = 5 - 8$$

$$y = -3$$

$$\text{has sol. sol.}$$

$$x = 2; y = -3$$

* (151) A hotel has 45 rooms and 115 beds.

Knowing that there are only double rooms and triple rooms, how many rooms are there of each type? Write the equations and then solve the system.

x: Habitaciones (triples)

y: Habitaciones (dobles)

$$x + y = 45$$

$$2x + 3y = 115$$

$$-2x - 2y = -90$$

$$2x + 3y = 115$$

$$y = 25$$

$$2x + 3 \cdot 25 = 115$$

$$-2x = 115 - 75$$

$$2x = 40$$

$$x = \frac{40}{2} = 20$$



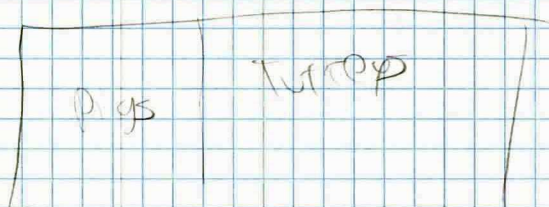
$$x + y = 45$$

$$\frac{x}{3} + \frac{y}{2} = 45$$

25 triples

20 doubles

(157) A farm has pigs and turkeys, in total there are 58 heads and 168 paws. How many pig and turkeys are there?



$$x + y = 58$$

$$4x + 2y = 168$$

There are:

(x) Pigs: 26

(y) turkeys: 32

$$-2x + -2y = -116$$

$$4x + 2y = 168$$

$$2x = 52$$

$$x = \frac{52}{2} = 26$$

$$26 + y = 58$$

$$58 - 26 = y$$

$$32 = y$$

* (158) John says to Peter, "I have double the amount of money that you have" and Peter replies, "If you give me 6 dollars we will have the same amount of money". How much money does each have?

$$2x \text{ Peter: } 2x$$

$$12 \text{ John: } x$$

$$x + 6 = 2x - 6$$

$$12 = x$$

(161) A hotel has 50 rooms and 87 beds.

Knowing that there are only single rooms and double rooms, how many rooms are there of each type?

$$\text{Doubles: } 37$$

$$\text{Individuals: } 13$$

$$x + y = 50$$

$$2x + y = 87$$

$$-x - y = -50$$

$$2x + y = 87$$

$$x = 37$$

$$37 + y = 50$$

$$50 - 37 = y$$

$$13 = y$$